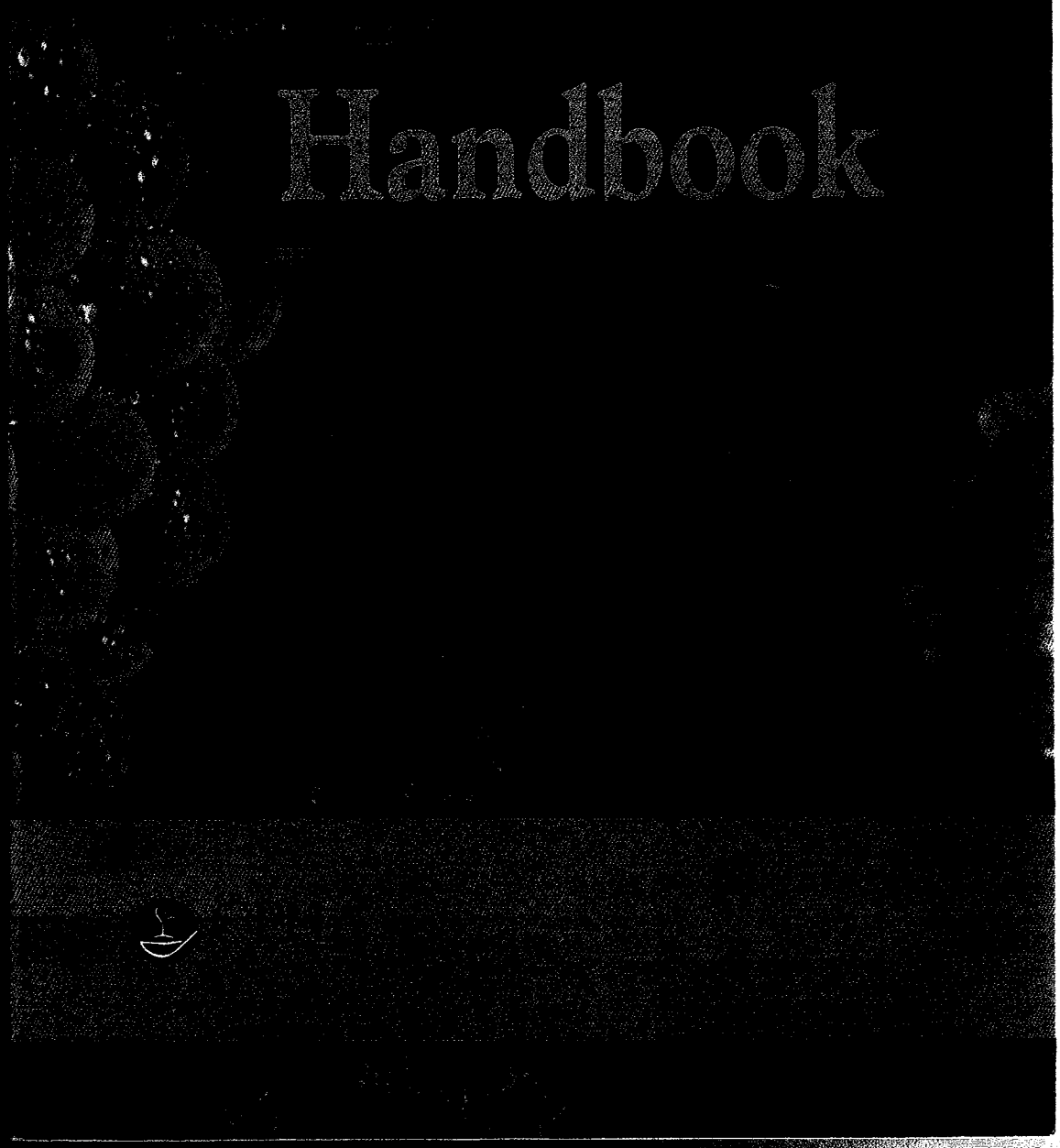
Western Fertilizer Handbook



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9

Soil and Tissue Testing

Soil and plant tissue analyses are among the best guides to the wise and efficient use of fertilizers and soil amendments. They are Best Management Practices that can help in producing high-yielding, high-quality crops while maintaining environmental quality. Useful recommendations resulting from these analyses are dependent upon accurate sampling, analysis, and interpretation based on sound research, practical experience, and good judgment. The interpretive guides presented here apply generally throughout the West. They

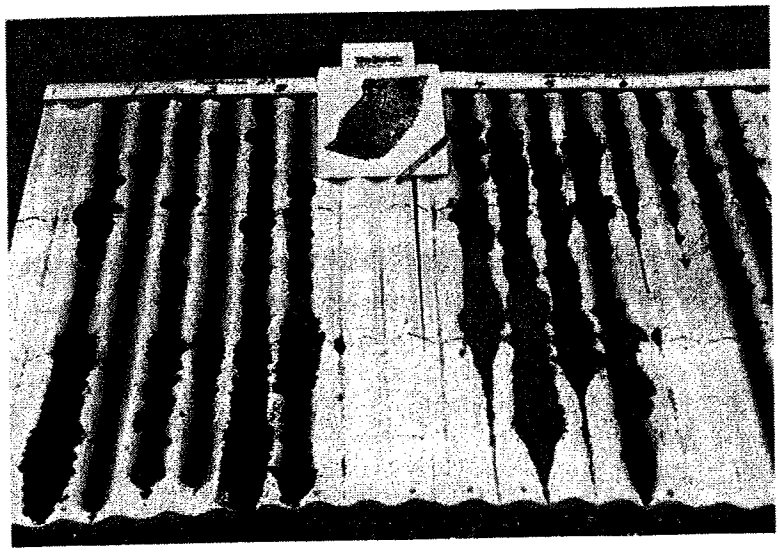

FIGURE 9–1. Soil variability within the same field can often be substantial, as depicted by these 3-foot soil cores from a 40-acre field.

should be used only with data obtained from samples collected and analyzed by using the procedures specified. The user is advised to contact the local agricultural extension service or Certified Crop Advisor (CCA) for recommendations applicable to specific cropping systems.

Soil and plant analyses complement each other. Soil analyses are useful for estimating organic matter levels, soil texture (water-holding capacity), and general nutrient availability and for evaluating pH and salt problems. They have the advantage that they can be completed and the information used prior to planting. Plant analyses are useful for determining the nutritional status of established, deep-rooted perennials, such as alfalfa, trees, and vines, where soil samples of the entire feeding zone are difficult to obtain and interpret. They are useful also in diagnosing the causes of poor growth, evaluating the effectiveness of fertilizer treatments, following the nutrient status of plants throughout the growing season, and managing quality factors.

Satisfactory recommendations based on soil or tissue tests depend upon three factors: collection of a representative sample, accurate analysis, and proper interpretation of the analytical results.

SOIL TESTING

Sampling

The first step in soil testing is the collection of a representative sample. The sample must accurately represent the soil in which the crop is being or is to be grown. Analytical results obtained from the laboratory can be no better than the sample submitted. Sample collection is complex and probably the greatest cause of variability in soil testing.

The sample submitted to an analytical laboratory may weigh about a pound but may represent more than 100 million pounds of soil (a foot of soil over 25 acres). Recommendations for maybe hundreds or thousands of dollars' worth of fertilizers and amendments

are based on the results of the laboratory analysis. It is indeed foolish to send a non-representative sample to the laboratory. Site-specific farming addresses this (Chapter 8).

Soils can be extremely heterogeneous (Figure 9–1). They can vary in both their horizontal and vertical dimensions. Management practices such as leveling, backhoeing, trenching, fertilizing, and cropping can further increase this natural heterogeneity. This variability should be recognized and, if possible, taken into account when soil samples are collected and fertilizer applications are made. On a practical basis, samples are usually collected to represent areas that may be fertilized and managed separately. A minimum of 10 to 20 subsamples should be collected from within a management area. The larger the area represented by a sample, the greater the chance of variability. Site-specific fertilizer management may necessitate sampling by the acre as opposed to every 20 to 40 acres or more.

Sampling depth:

- *0- to 3-inch: Soil permeability*

  Sample no deeper than the top 3 inches if irrigating with water low in salts. See also below under "0- to 72-inch" sampling depth.

- *0- to 6-inch: Soil pH and organic matter (reduced tillage)*

  Generally, limit to the top 6 inches, as this is the zone most easily amended and with greatest microbial activity. Also note that lime recommendations are generally based on about a 6-inch depth of soil.

- *0- to 12-inch: General fertility*

  The top 12 inches of soil provides a good indicator under most field conditions. Discarding the top few inches is not advised, as this may have the effect, for example, of raising the true pH level and lowering the true organic matter and zinc levels. However, cotton research has determined that the best indicator of potassium levels is the 5- to 15-inch zone. Results should be interpreted accordingly.

- *0- to 72-inch: Sodium, chloride, boron, nitrate, sulfate*

  Include at least the main rooting depth of the plant. Some may prefer to sample in 1-foot increments or each textural change to monitor trends down the profile as deep as 6 feet.

Sampling area:

- *Banded fertilizer*

  Collection of a representative sample is extremely difficult from a field that has received banded fertilizer applications. Consult your laboratory or extension specialist for specific instructions. It may be necessary to sample out of the banded area altogether, as it takes only a trace of fertilizer to significantly raise nutrient levels in a soil test.

- *Broadcast fertilizer*

  Sample from areas of main root development.

- *Low-volume fertigation (microirrigation)*

  Do not sample directly below emitters. Consider sampling from around half the radius of the wetting zone.

Soil analyses can prove quite helpful when attempting to diagnose field problems. Paired samples should be collected from adjacent normal and affected areas, and the analytical results compared.

Before collecting and submitting soil samples for analysis, obtain specific information from the laboratory that will be conducting the analysis. The laboratory will also have proper sample bags and information sheets. For future reference, keep detailed records on areas sampled, fertilizers used, crops grown, residue management, yields, and other pertinent production aspects.

To be accurately analyzed for pH and nitrate-nitrogen (NO_3-N), samples should be either frozen or dried (below 100°F) as soon as possible to prevent further microbial activity and possible pH reduction. Normally this is not a concern if the samples are delivered to the laboratory within two days.